

1st International Workshop on Doping Semiconductor Nanostructures

Naval Research Laboratory, Washington DC, 9–11 January 2006

Sponsored by Office of Naval Research, Office of Naval Research Global, & Evident Technologies

Schedule-at-a-glance

Sun, January 8	Informal get-together, hosted by Evident Technologies, from 6:00-8:00 pm at the Radisson Hotel (Salon 1)
Mon, January 9	Workshop from 9:15 am to 4:30 pm Poster session from 5:30 pm to 8:00 pm at the Radisson (Salon 1)
Tue, January 10	Workshop from 9:00 am to 4:40 pm
Wed, January 11	Workshop from 9:00 am to 11:30 am

Last-minute reminders

- In order to enter NRL and attend the Workshop, you will need to bring government-issued photo identification with you, as follows. (i) US citizens: driver's license (if it has a photo) OR passport. (ii) US Permanent Resident: Green Card. (iii) Foreign national: passport.
- Please do not bring a camera or a camera cellphone to NRL, or you will be required to leave it outside the Lab. Laptops are permitted inside NRL. However, there is no wireless service inside the Lab, so you will not have internet access while at NRL.

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Registration desk:	202-404-3024 (during Workshop)
Workshop email:	wdsn06@dave.nrl.navy.mil

Workshop hotel

Radisson Hotel Reagan National Airport (see the attached map, Figure 1)
2020 Jefferson Davis Highway, Arlington VA 22202
Telephone: 703-920-8600, Fax: 703-920-2840

Sunday evening reception

We cordially invite all participants to an informal reception from 6:00 to 8:00 pm at the Radisson Hotel, in Salon 1. Light food and drinks will be served, courtesy of Evident Technologies.

Workshop location

The workshop will be held in Building 226 at the Naval Research Laboratory (NRL) in Washington DC. A map of NRL, showing the location of Building 226, is attached (Figure 2).

Transportation to the Naval Research Lab

If you are staying at the Radisson, a bus from NRL will take you to and from the Workshop each day, unless we make separate arrangements for you. **This bus will depart each morning promptly at 8:00 am from the front door of the Radisson.** If you miss the bus you will have to take a taxi; you will also have to make special arrangements to get through NRL Security by calling one of us. In the afternoons, the bus will depart from NRL at the times shown in the Program.

IMPORTANT: Please do not forget to bring government-issued photo identification with you when you board the bus—see page 1 for requirements.

Taxi service to the Naval Research Lab

Yellow Cab: 202-544-1212

Diamond Cab: 202-398-0500

Security at the Naval Research Lab

All Workshop participants must wear an NRL Security badge while at the Lab. The badges will be issued on Monday morning in Building 226, at the Workshop registration desk. Each participant must also sign in each day at the registration desk. At the end of each day we will collect badges from those not attending any further sessions. On Wednesday we will collect all badges.

If you drive your own car to NRL, you must stop at the front gate and tell them you are attending the Workshop on Doping Semiconductor Nanostructures. You will then be allowed to drive to Building 226 (see the map, Figure 2). If you are not a US citizen, you will be required to show your Green Card. Foreign nationals without a Green Card cannot enter NRL without an escort.

Oral presentations

Oral presentations are allotted 40 minutes in total: 30 minutes for the talk and 10 minutes for discussion. Chairs are asked to keep the speakers on schedule and to moderate the discussions. Speakers may use their own laptop, or transfer their talk to one of the workshop computers (Windows XP and Mac OSX) using a flashdrive or CD, or use overhead transparencies. If you are using a computer, please test your talk before the scheduled presentation time.

Poster presentations

Poster presentations will be on Monday evening from 5:30 to 8:00 pm at the Radisson Hotel, in Salon 1. You may put up your poster shortly before this. Please take your poster down at the end of the poster session. Posterboards are approximately 3.5 feet \times 5 feet. They are not assigned

to particular posters, so just use any one. Light food and drinks will be served during the poster session, courtesy of Evident Technologies.

Information for session chairs

Each session consists of one, two, or three talks. Please start your session promptly. It is important to end the sessions on time, because the NRL bus must take participants back to the Radisson hotel at the scheduled times. A timer will be provided. The oral presentations should end after 30 minutes; set the timer initially for 25 minutes, and then for 5 minutes more. Each talk is followed by ~10 minutes of discussion. Please close the discussion in time for the next talk or break to begin on schedule. Speakers should use the lapel microphone provided. A handheld microphone can be used for questions from the audience.

Coffee breaks

There will be one break during each morning and afternoon session. For the morning breaks, coffee and tea and cookies will be available. For the afternoon breaks there will be coffee, tea, cookies, and cold drinks.

Email access

Due to NRL security regulations, there will be no internet access available to Workshop participants from inside NRL. If you have an urgent need, please contact one of the organizers and we will try to help.

Telephone access

You are free to use your cell phone while at NRL, but be aware that the coverage can be unreliable. There are also three Workshop telephones immediately outside the auditorium. They are free for anyone to use for calls inside the United States. Dial 99-1-AreaCode-Number.

Lunch during the Workshop

Most Workshop participants have pre-ordered box lunches, for \$8 per day. If you have pre-ordered a box lunch, please pay during registration. Lunch boxes will be available in the registration area, and tables for dining will be next door in the Freidman room. If you did not pre-order a box lunch, you can eat at NRL's Cafeteria (Building 28) or at the smaller Northgate Deli (inside Building 222). See the attached map for walking directions (Figure 2).

Transportation

There are three airports serving the Washington area: Ronald Reagan Washington National Airport, Washington Dulles International Airport, and Baltimore/Washington International Airport. To get from your airport to the Workshop hotel (the Radisson Hotel Reagan National Airport) see the information below.

FROM WASHINGTON NATIONAL AIRPORT

Via shuttle: The Radisson Hotel has a courtesy shuttle that will pick passengers up at the airport. Use the courtesy phone by the baggage claim to arrange this, or call the hotel directly at 703-920-8600.

Via Taxi: A taxi from National Airport to the Radisson Hotel will cost about \$10 (it's very close).

Via Metro: There is a Metro station at National Airport. Purchase a Metro ticket for Crystal City. Take either the Blue line (in the direction Addison Road) or Yellow line (in the direction Mt. Vernon Sq.-UDC) one stop to Crystal City. The hotel is a short walk (one or two blocks) from the Metro stop; see the attached map (Figure 3) for detailed walking directions.

FROM DULLES AIRPORT

Via Taxi: A taxi from Dulles Airport to the Radisson Hotel will cost about \$75.

Via shuttle bus: A less expensive alternative is the SuperShuttle (1-800-BLUE-VAN), which costs \$26 per person from Dulles to the Radisson Hotel, and should be reserved in advance.

Via Metro: An even less expensive (but more complicated) alternative is to take a Washington Flyer bus to the closest Metrorail station at West Falls Church; detailed instructions are here. Then take the Orange line Metro to Rosslyn. Change there to the Blue line (in the direction Franconia-Springfield) and travel to the Crystal City station. The hotel is a short walk (one or two blocks) from the Metro stop; see the attached map (Figure 3) for detailed walking directions.

FROM BWI AIRPORT

Via Taxi: A taxi from BWI Airport to the Radisson Hotel will cost about \$85.

Via shuttle bus: A less expensive alternative is the SuperShuttle (1-800-BLUE-VAN), which costs \$41 per person from BWI to the Radisson Hotel, and should be reserved in advance.

Via Metro: An even less expensive (but more complicated) alternative is to take a BWI Express Metro bus to the closest Metrorail station at Greenbelt; detailed instructions are here. Then take the Green line Metro to L'Enfant Plaza. Change there to the Yellow line (in the direction Huntington) and travel to the Crystal City station. The hotel is a short walk (one or two blocks) from the Metro stop; see the attached map (Figure 3) for detailed walking directions.

Restaurants near the Radisson, with recent reviews

- Kabob Palace
2315 S Eads St, Arlington 22202, 703-486-3535, Distance: 0.3 mile
Open daily, Kabob Palace serves authentic Pakistani food for dine-in or take-out. The menu offers regular specials along with lamb, beef, and vegetable dishes. However, kabobs (both lamb and chicken) are the house specialty. Try charred lamb chops and fresh, warm pita

bread, or sample the daily vegetable special. Prices at this Crystal City eatery are around \$5 per entree. Casual dress.

- **Ristorante Portofino**

526 S 23rd St, Arlington 22201, 703-979-8200, Distance: 0.3 mile

This upscale Italian restaurant combines elegance with flavorful comfort foods like lasagna, spaghetti, and veal parmesan. Family-owned and operated for more than 30 years, Portofino has perfected its menu and service. Consider a table in the peaceful garden room, and look for specials like linguini in green pesto or baked eggplant with ricotta. Reservations recommended. Business casual attire.

- **Top Thai**

523 S. 23rd St., Arlington, VA, 703-521-1305, Distance: 0.3 mile

The food is spicy at this family-run Thai restaurant, but even tender tongues will find delectables on this extensive menu: satay of beef, pork, or chicken; soothing noodle dishes like the familiar pad Thai and Rard Nar, thick rice noodles with broccoli and a choice of meats in brown gravy; and stir-fries such as pork with fresh ginger and vegetables in bean sauce.

- **Ruth's Chris Steak House**

2231 Crystal Dr, 11th floor, Arlington 22202, 800-544-0808, Distance: 0.4 mile

This chain of steakhouses bills itself as "Home of Serious Steaks." Ruth's Chris is also known for great service, an extensive wine list, and an atmosphere of comfortable elegance. This location also offers fabulous views of the DC skyline. Reservations recommended. Business casual attire.

- **Saigon Crystal**

536 S. 23rd St., Arlington, VA, 703-920-3822, Distance: 0.3 mile

This engaging restaurant, with an outdoor deck and native musical instruments gracing the walls, does many things well. It's worth getting one of the combo platters to start: a crispy pork-and-mushroom-crammed spring roll, tender sweet slices of beef-on-a-stick, a marvelous summer roll, and one of the better renditions of shrimp toast around-the secret's in the French bread and fragrant shrimp paste. Classic fiery salads such as beef with shredded papaya are nicely done; a vegetarian version with bits of fried tofu is almost as interesting as the beef. Then there are the whole fish: red snapper glazed in black-bean or ginger sauce and rockfish steamed or deep-fried with red pepper-and-carrot-studded gravy.

- **Morton's**

1631 Crystal Sq Arcade, Arlington 22202, 703-418-1444, Distance: 0.3 mi

Morton's is an upscale chain steakhouse that serves a lot more than just American Angus. The decor is classy. Expect to be treated well by the friendly waitstaff, who present dinner selections by bringing out a cart of options and telling you stories about each dish. Favorite entrees include blackened swordfish, fresh Maine lobster, and a 24-ounce porterhouse. Reservations suggested. Business dressy attire.

- **Little Viet Garden**

3012 Wilson Blvd, Arlington, 703-522-9686, Distance: 4 miles

Upscale Asian cuisine, this restaurant offers lovely outdoor seating. You'll truly feel as if

you’ve entered a garden, whether you dine on the greenery-lined patio or in the tropical dining room. Great spring rolls and spicy-hot curries draw raves, of course, but you’ll also find unique entrees like caramel chicken, ginger-sauced flounder, and shrimp-stuffed crepes. Plenty of affordable noodle dishes make the restaurant a quick and affordable option for lunch. Casual attire.

- *23rd Street, one block south of the Radisson*—Some eateries on Arlington’s South 23rd Street “restaurant row” don’t quite merit full reviews but are memorable for a particular dish or as casual places to grab a bite. Though the food at the popular and always busy **Cafe Italia** (519 S. 23rd St., 703-521-2565; moderate to expensive) is, for the most part, standard Italian fare, the veal osso buco, a special on Tuesday, Thursday, and Saturday, is a standout and definitely worth a trip. The street also has a couple of appealing hangouts. Long a popular spot, the **Freddie’s Beach Bar & Restaurant** (555 S. 23rd St., 703-685-0555; inexpensive) is in transition with new owner Freddie Lutz, the much-loved former maitre d’ at Cafe Italia. Lutz says he’s transforming the rustic pub into a bar with an islandy feel and food to match. Another hot spot, the **Crystal City Sports Pub** (529 S. 23rd St., 703-521-8215; inexpensive), wallpapered with sports memorabilia, is good for a burger and a beer and homey specials like pork chops and mashed potatoes.

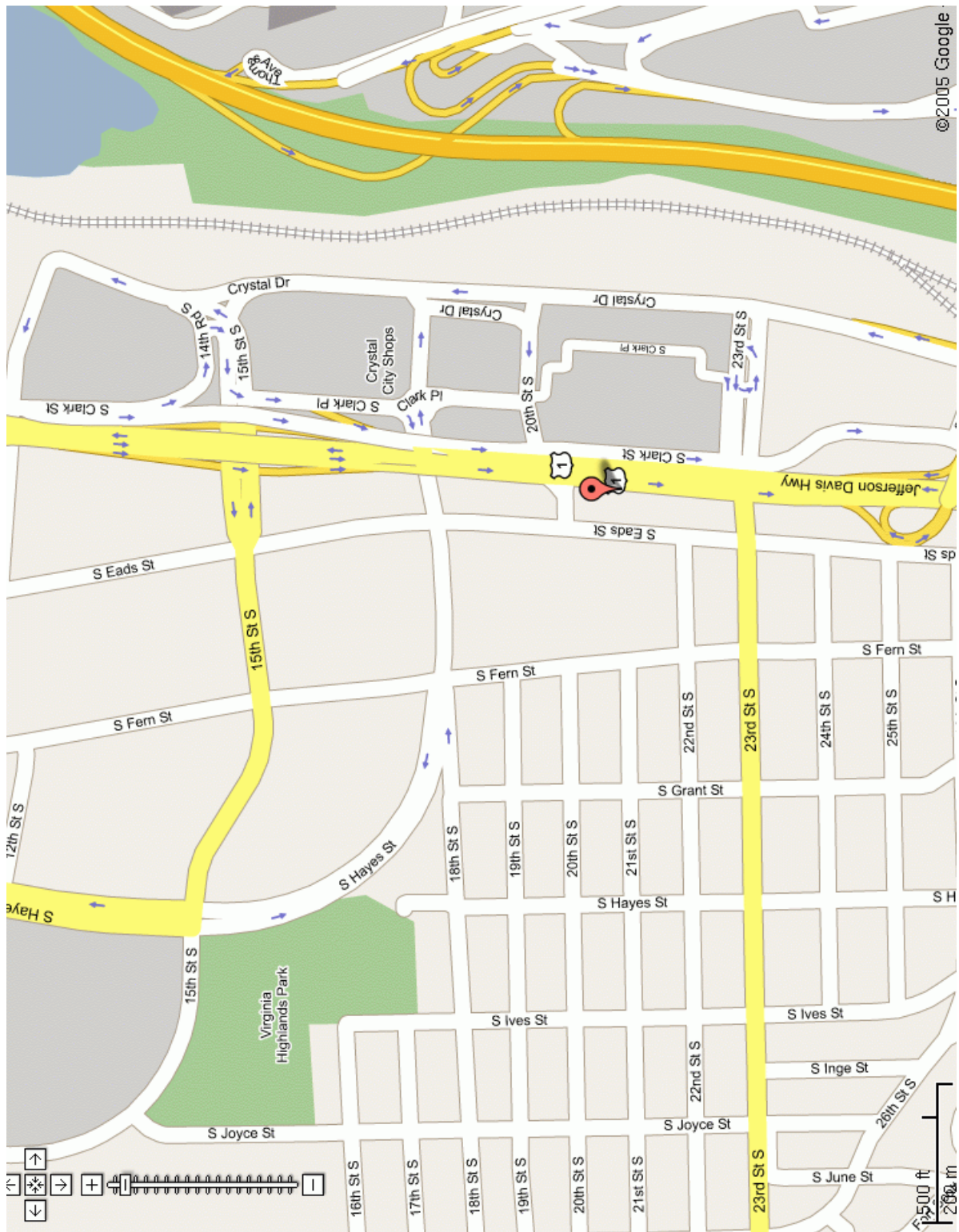


Figure 1: Crystal City, Arlington, in the vicinity of the Radisson Hotel (marked)

Location of Buildings at NRL Washington

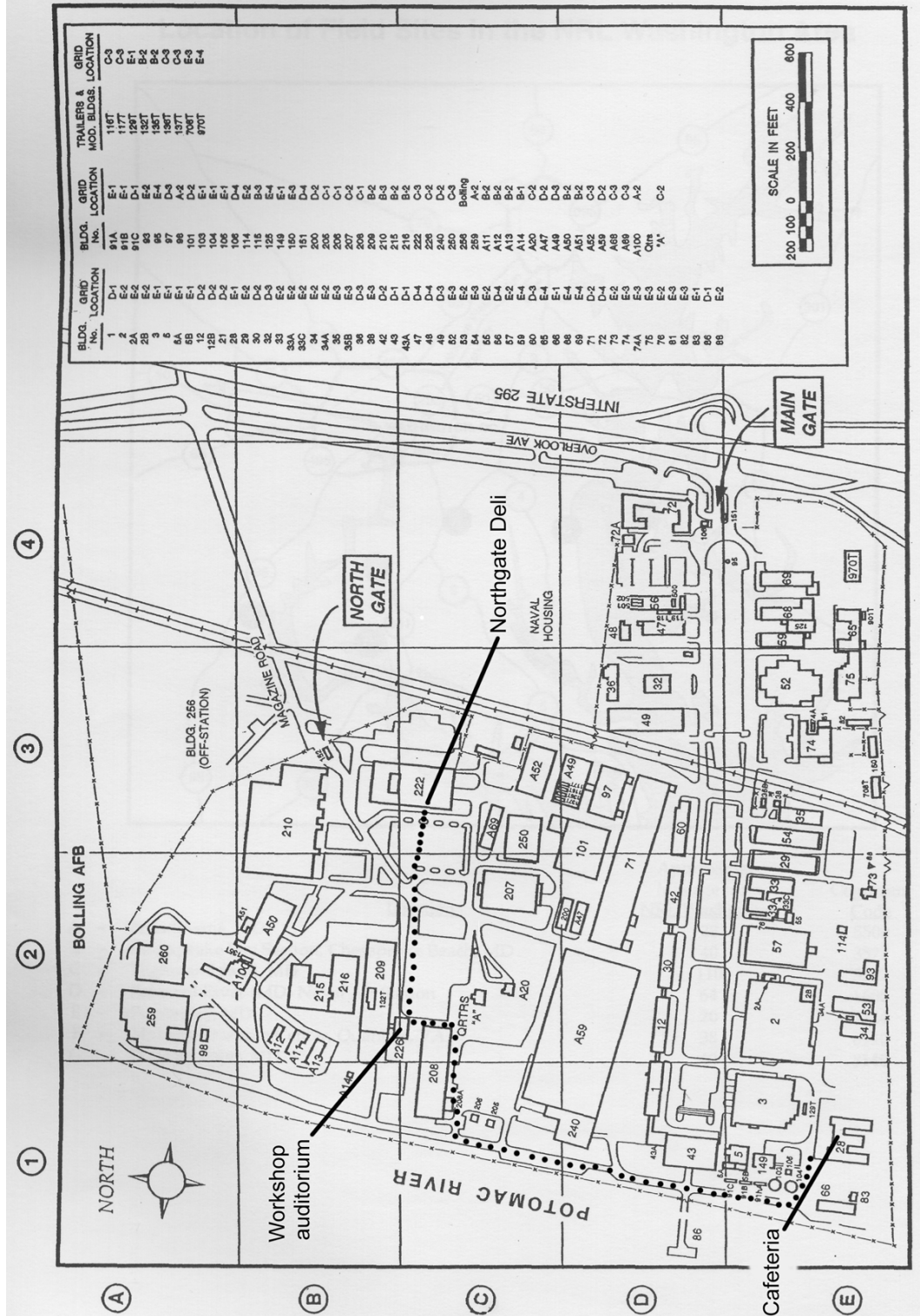


Figure 2: Workshop auditorium and two alternative eating locations. Recommended walking routes are marked by dots.



Figure 3: Walking route from Crystal City Metro Station to the Radisson Hotel

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Scientific program

MONDAY MORNING

08:00 *BUS DEPARTS FROM HOTEL*

08:30 *REGISTRATION AT NRL, BUILDING 226*

Welcome and introductory remarks

09:15 Richard Colton (NRL) & Alexander Efros (NRL)

Nanocrystals with electrons & holes — Arthur Nozik (National Renewable Energy Lab), chair

09:30 Philippe Guyot-Sionnest (University of Chicago) “Charged colloidal quantum dots”

10:10 Celso de Mello Donega (Utrecht University, Netherlands) “Probing the wavefunction of dopants in ZnO nanocrystals”

10:50 *COFFEE BREAK*

Doping superlattices — David Norris (University of Minnesota), chair

11:20 Christopher Murray (IBM) “Doping nanocrystal superlattices”

12:00 *LUNCH*

MONDAY AFTERNOON

Nanowire heterostructures — Pehr Pehrsson (NRL), chair

13:30 Charles Lieber (Harvard University) “Doping and the electronic properties of single-component, axially modulated, and core/shell radial-heterostructure nanowires”

14:10 Gyu-Chul Yi (Pohang University, Korea) “ZnO nanorods and heterostructures”

14:50 *COFFEE BREAK*

Phosphors — Ramesh Bhargava (Nanocrystals Technology), chair

15:10 Jeffrey Gerbec (Mitsubishi Chemical Corporation) “Doped nanophosphors: an industrial perspective”

15:50 Jeff Coffer (Texas Christian University) “Erbium-doped group-IV nanocrystals and nanowires: photophysical and structural impact of rare-earth location”

16:45 *BUS DEPARTS FOR HOTEL*

17:30 *POSTER SESSION AND RECEPTION AT HOTEL*

MONDAY EVENING

17:30–20:00 Poster session at Radisson Hotel

- Matt Beard (National Renewable Energy Lab) “Novel carrier processes in lead-salt quantum dots and quantum-dot arrays: multiple exciton generation, charge separation, and transport”
- Daniel Gamelin (University of Washington) “Magneto-optical spectroscopic studies of colloidal diluted-magnetic-semiconductor quantum dots”
- Sergei Ivanov (Los Alamos National Lab) “Single-exciton amplified spontaneous emission in heterostructured core/shell semiconductor quantum dots”
- Masaru Kuno (Notre Dame University) “Synthesis, characterization, and optical properties of solution-grown, quantum-confined, semiconductor nanowires”
- William Liu (University of Washington) “Transition-metal doped oxide semiconductors: synthesis, characterization, and activation of high-T_c ferromagnetism”
- Xiaogang Peng (University of Arkansas) “Targeted doping of semiconductor nanocrystals”
- Jeff Peterson (University of Rochester) “Fluorescence from individual lead-sulfide quantum dots”
- Andrew Shabaev (NRL) “Optical properties of semiconductor nanorods”
- Blake Simpkins (NRL) “Electronic conduction in GaN nanowires”
- Terry Tritt (Clemson University) “Composite thermoelectric materials using nanoscale precursors”
- Qian Wang (Virginia Commonwealth University) “Structure and magnetic properties of Cr-doped GaN nanotubes”
- Jinkyung Yoo (Pohang University, Korea) “Doping of Al and Ga in ZnO nanorods”
- Lijun Zu (University of Minnesota) “The impact of ripening on manganese-doped ZnSe nanocrystals”

TUESDAY MORNING

08:00 *BUS DEPARTS FROM HOTEL*

Optical properties — James Merz (University of Notre Dame), chair

09:00 Aleksey Ekimov (Ioffe Institute & Nanocrystals Technology) “Size effects in photoluminescence of doped nanocrystals”

09:40 Minoru Fujii (Kobe University, Japan) “Optical properties of impurity-doped Si nanocrystals”

10:20 *COFFEE BREAK*

Dilute magnetic semiconductors — Xiaogang Peng (University of Arkansas), chair

10:40 Daniel Gamelin (University of Washington) “Synthesis, spectroscopy, and physical properties of nanocrystalline oxide diluted magnetic semiconductors related to spintronics”

11:20 Brian Korgel (University of Texas-Austin) “Colloidal Mn-doped InAs and InP nanocrystals”

12:00 *LUNCH*

TUESDAY AFTERNOON

Magnetic interactions — Berry Jonker (NRL), chair

13:30 James Chelikowsky (University of Texas-Austin) “Magnetic properties of Mn-doped semiconductor nanocrystals”

14:10 Geoffrey Strouse (Florida State University) “Turning on ferromagnetic exchange in doped nanocrystals”

14:50 *COFFEE BREAK*

Surface chemistry — Tom Reinecke (NRL), chair

15:20 Michael Steigerwald (Columbia University) “Low-temperature organometallic preparations of metal-oxide and metal-chalcogenide nanostructures”

16:00 Steven Erwin (NRL) “Doping semiconductor nanocrystals: the role of surface adsorption”

17:00 *BUS DEPARTS FOR HOTEL*

WEDNESDAY MORNING

08:00 *BUS DEPARTS FROM HOTEL*

New nanostructure doping methods — Masaru Kuno (University of Notre Dame), chair

09:00 Liberato Manna (National Nanotechnology Lab, Italy) “Growth of elaborate nanocrystal structures: new synthetic approaches and computational support”

09:40 Richard Robinson (University of California-Berkeley) “Creation of nanocrystal heterostructures through partial cation exchange”

10:20 Lincoln Lauhon (Northwestern University) “Three-dimensional composition mapping of semiconductor nanowires using atom-probe tomography”

11:00 *COFFEE BREAK*

Closing remarks and departure

11:15 David Norris (University of Minnesota) and Tom Kennedy (NRL)

11:45 *BUS DEPARTS FOR HOTEL*